APPENDIX B - VDOT TMS CONCEPT

The planned architecture for VDOT TMS central hardware (as documented in Conceptual Design Report prepared for VDOT - 1993 and submitted to NEC by VDOT - 1995) is shown in Exhibit B-l. The TMS will be composed of numerous interconnected subsystems. Each subsystem will be run by a separate PC. A key feature of the design is that each subsystem will function regardless of whether the others are operating. The modular design allows one aspect of the system, such as ramp metering, to be upgraded with no change or disruption to the remainder of the system.

The TMS will have seven subsystems, as follows:

- Closed circuit television
- Traffic monitoring
- Traffic database
- Ramp metering
- Reversible roadway gates
- Variable message signs
- Security alarms

CLOSED CIRCUIT TELEVISION SUBSYSTEM

The closed circuit television subsystem will transmit camera control commands to the camera controllers in the field via the twisted pair network. This PC will accomplish all of the control functions (i.e., pan, tilt, zoom, etc.)

At the TMS, each receiver output creates a different television carrier frequency, and all the resultant signals are combined onto a single coaxial cable. This cable is routed to the desktop TV's, the monitors located in the control room walls, and the TMS workstations functioning like a small cable television system. The TMS user can select the camera to view by tuning the desktop TV, wall monitor or the video board in a workstation, to the corresponding station.

Software in the TMS user workstations will permit viewing of individual pictures, or sequential viewing of pictures from selected cameras on the workstation's screen. When enabled by a user with camera control privileges, the video control software in the workstation would automatically display the appropriate scene when an incident has been detected.

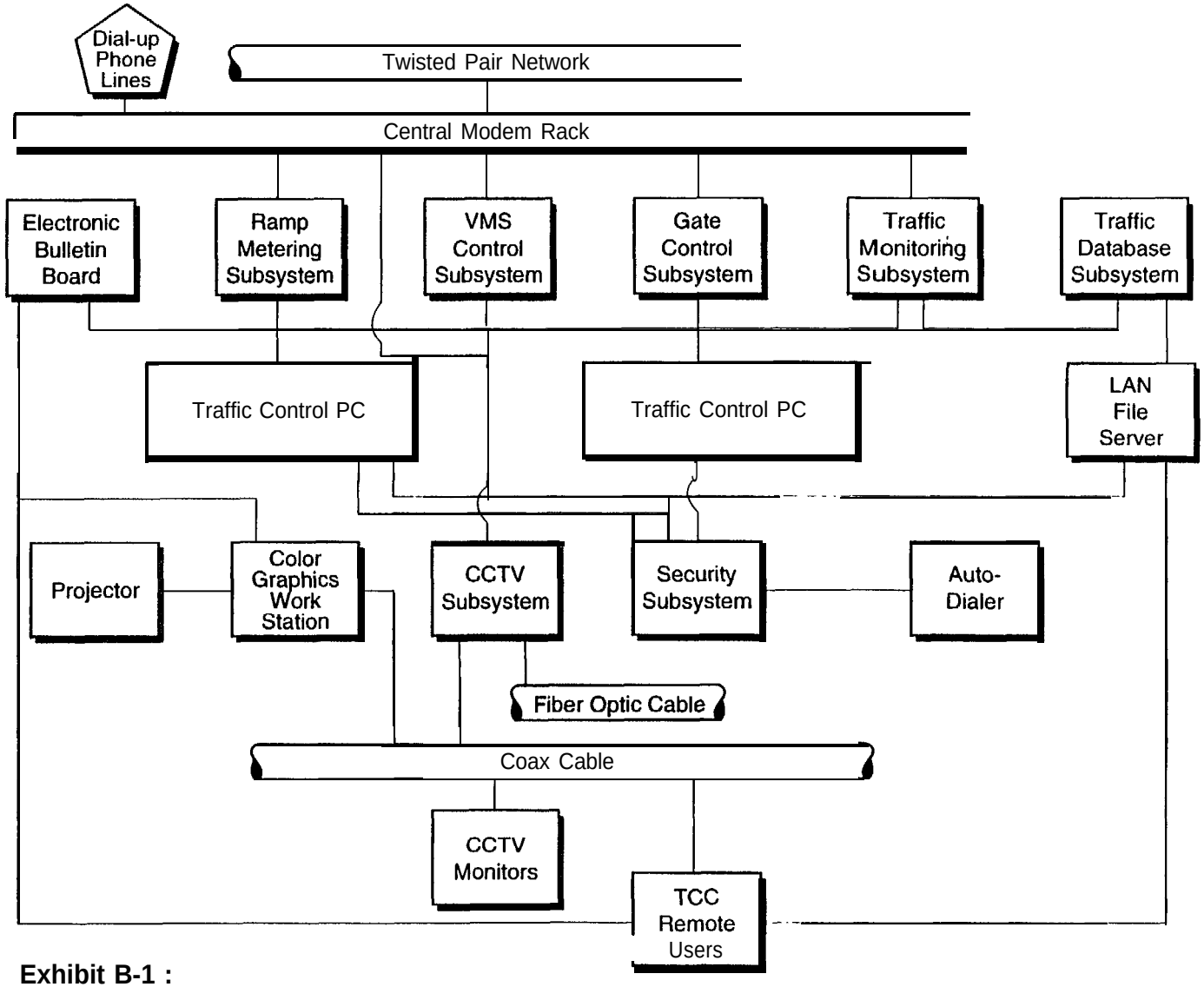

Exhibit B-1 :
VDOT TMS Functional Block Diagram

If the user has camera control privileges, and if no one else is currently controlling the camera, the user can control a camera from the workstation. The commands are transferred over the TMS's local area network to a camera control computer that sends the appropriate commands to the camera controller in the field.

TRAFFIC MONITORING SUBSYSTEM

The traffic monitoring subsystem will detect incidents based on volume and occupancy reported from adjacent traffic monitoring stations. Stations will be approximately one-half mile apart. At each interchange, traffic in all lanes, and on all ramps, will be measured to determine the volume on the roadway segment(s). Also, there are classification stations, spaced approximately one mile apart on each roadway segment, which will also measure speed in each lane.

The traffic monitoring PC will continuously feed information about current traffic and suspected incidents to the traffic control PC, so that the traffic control PC can pass the information on to users and also make appropriate changes to the signs, gates, and ramp meters. The traffic control PC will also accumulate volume, occupancy, and speed for each detector until the totals are requested by the traffic data base PC.

The traffic monitoring PC can also present text reports of current traffic and incident data on its screen in response to commands from its keyboard. This feature would be used if the traffic control or electronic bulletin board PC was out of service.

TRAFFIC DATABASE SUBSYSTEM

This subsystem compiles a historical data base of the volume occupancy, and speed of traffic at selected locations for selected time intervals. It obtains this data by requesting it from the traffic control PC at regular intervals. The traffic control PC will accumulate all three measures from the appropriate detectors in the system, and then transfer the cumulative or

interface that allows a user to specify data collection schedules, covering only selected locations and for a different data collection frequency. Such a scheduler will permit gathering any desired set of data without collecting unwanted data.

A user at a TCC workstation can access the traffic database PC via the local area network A user can specify a data collection schedule and also upload the collected data, or a portion of it, to a workstation for printing or analysis.

Data is stored on the PC's hard disk in a format that makes it easy to use common database software, such a Paradox or dBASE, to manipulate the data. Because of the high volume of data that the subsystem could generate, the subsystem will incorporate a means, such a tape or floppy disks, for storing the collected data so that it can be purged from the PC's hard disk.

RAMP METERING SUBSYSTEM (FUTURE IMPLEMENTATION)

The ramp metering subsystem will consist of a ramp metering PC that communicates over the twisted pair networks with Model 170 traffic controllers that will control signals on the ramps. The ramp metering PC would monitor the field equipment and report failures. It will also relay instructions about whether to meter and the proper rate from either the operator or the traffic control PC.

REVERSIBLE ROADWAY GATE SUBSYSTEM

The gates will respond to instructions from a Gate Interface Unit (GIU). The GIU will communicate directly with the sign and gate controllers in the field and will respond to instructions from the gate control subsystem. In addition to the functions planned for the Gate Interlock Computer--safeguarding against conflicting gate positions, reporting equipment status, and permitting direct operator control of the gates--the gate control subsystem will also receive and respond to instructions from the traffic control PC. Those instructions may be originated by the traffic control PC, or relayed from a TCC workstation.

VARIABLE MESSAGE SIGN SUBSYSTEM

This subsystem allows communications and commands to and from the individual field elements (VMS). The format of the communication between the VMS PC and the traffic control PC provides the traffic control PC with control and information about sign status.

SECURITY ALARMS SUBSYSTEM

The security alarm subsystem will consist of a PC in the TMS. The PC will monitor the alarms from the fire suppression system, the uninterruptible power supply, and the climate control system. It will also monitor the pulses from the traffic control PC to ensure that operation of the traffic control PC has not been interrupted.

User Interface at the Traffic Control Center

Users will interact with the TMS via powerful desktop PCS or "workstations." These workstations will consist of 486 microprocessors and a 14-inch color monitor; and will be equipped with a graphics accelerator card and a video card, as well as the software necessary to communicate over a Local Area Network (LAN) system and to an Electronic Bulletin Board. The TMS user workstations will be connected by a local area network and other wiring to computers and video equipment that provide each user with the following capabilities:

- Graphic displays showing incidents, traffic conditions, and the status of equipment.
- A video image from a selected camera, or a sequence of images from a series of cameras.
- A text report, either printed or on the screen.
- Ability to control cameras, ramp meters, signs, and gates, subject to certain restrictions. Passwords will be used to allow certain users to have control privileges that others do not have.

  Ability to read and post data about incidents on an electronic bulletin board system shared by traffic reporters, emergency response agencies, and local jurisdictions.

- Ability to send and receive electronic mail messages to other workstations on the local area network.

User Interface At Remote Locations

Users at locations outside of the TMS will have the ability to access the VDOT TMS facilities utilizing workstations equipped with a modem. These workstations may be identical to the workstations located in the TMS, except that the capability to receive video signals would be reserved until some time in the future. These users will be able to display the traffic information graphically, with automatic updates to show current conditions.

Private users, at locations outside the TMS may also utilize their own PC equipped with a modem. These users will have the capability to dial in to a computer at the TMS to get current information about incidents and traffic conditions. This information will be available to the user in tabular form only, and will cover not only incidents detected by the TMS, but also those reported by traffic reporters and other jurisdictions. Authorized users will also be able to post information about incidents on the computer system, like the VDOT TMS staff.